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Long-Term Exercise Therapy Resolves Ethnic Differences in Baseline Health Status in Older Adults with Knee Osteoarthritis

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OBJECTIVES: To determine whether ethnicity was associated with baseline and 18-month health status within a merged sample of older adults with knee osteoarthritis (OA) from the Fitness Arthritis in Seniors Trial and the Arthritis, Diet, and Activity Promotion Trial.

DESIGN: Cross-sectional and prospective study.

SETTING: Center-based exercise therapy at two universities.

PARTICIPANTS: A total of 584 African-American (n = 143) and Caucasian-American (n = 441) adults aged 60 and older with knee OA were examined for baseline and 18-month health status.

MEASUREMENTS: Six-minute-walk distance, 36-item Short Form General Health Scale (SF-36 GHS), and Physical Functioning Questionnaire index score. Ethnicity was obtained via self-report.

RESULTS: Analyses of covariance testing the effect of ethnicity, adjusted for demographic and health status covariates, revealed significant effects for ethnicity upon baseline 6-minute-walk distance and SF-36 GHS, with Caucasian Americans reporting better scores ($P = .001$), although these differences were not significant after 18 months of exercise therapy.

CONCLUSION: Ethnicity and baseline function are important factors that should not be overlooked in knee OA research involving exercise interventions. Moreover, not only should physical activity be recommended to improve functional outcomes, it may also be a useful strategy in reducing health disparities. **J Am Geriatr Soc 53:1469–1475, 2005.**

Key words: ethnicity; exercise; health; osteoarthritis

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Knee osteoarthritis (OA) is an incurable joint disease characterized by degeneration of hyaline cartilage with secondary changes in periarticular bone and soft tissues.[1,2] The vast majority of individuals with knee OA are aged 65 and older,[3] and after age 60, the prevalence of women with knee OA is roughly twice that of men.[4] Therapeutic goals focus on palliative strategies and improvement of disability.[5] The prevalence of knee OA is expected to escalate 50% by 2020, which emphasizes the urgency of treating and preventing this condition.[6]

Disability is a salient factor affecting the health status of individuals afflicted with the disease.[7] The disability attributable to knee OA is comparable with that due to cardiovascular disease,[8] and the presence of other comorbidities increases the likelihood of long-term disability associated with knee OA.[9] Demographic factors such as age,[10] marital status,[11] socioeconomic status,[12] and psychosocial factors such as self-efficacy[13] and social support[14] influence the degree of disability and pain associated with knee OA, often independently of the structural damage indicated by radiographic evidence.

Regular physical activity affects the etiology and progression of knee OA. Several epidemiological studies and randomized clinical trials have demonstrated a consistent benefit of physical activity with regard to physical function.[15] The Observational Arthritis Study in Seniors, the Fitness Arthritis in Seniors Trial (FAST), and the Arthritis, Diet, and Activity Promotion Trial (ADAPT) have demonstrated that physical activity leads to enhanced physical function[16] and enhanced health-related quality of life.[13] Moreover, participation in regular physical activity leads to less knee pain[15] and greater knee strength.[17] The American College of Sports Medicine[18] recommends that individuals with OA exercise with multiple short bouts of low-impact, low-intensity exercise and that increases in duration are preferable to increases in intensity. One study[19] recommended that home-based programs incorporating short bouts of activity may be used in conjunction with or as an alternative to structured, center-based programs.

Although the health status and disability associated with knee OA are well documented, there is a paucity of literature regarding ethnic comparisons of the effects of knee OA. African-American women were twice as likely as Caucasian-American women to have knee OA,[20] and in

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perimenopausal women, African-American women were almost three times as likely as Caucasian-American women to have radiographic evidence of knee OA.[21]

Some early studies comparing arthritis-related disability of ethnic groups typically compared Caucasians with an imprecise grouping of "non-Caucasians." Collectively, these studies found that, although Caucasians and non-Caucasians reported similar rates of arthritis, non-Caucasians were more likely to report difficulties in physical functioning.[11,22] Indeed, some reports estimate that African Americans have a higher prevalence of knee OA than Caucasian Americans.[23] The degree to which ethnicity plays a role in the effect of knee OA upon health status and physical function remains largely unexplored, particularly within randomized clinical trials involving exercise interventions. Drawing from the cardiac rehabilitation and pulmonary rehabilitation literature supporting the scientific study of sex and ethnic differences, along with the National Institutes of Health mandate to include women and minorities in studies,[24–26] it is prudent to consider ethnicity as a potential factor with respect to outcome research in knee OA.

Thus, the purpose of this investigation was to examine whether ethnicity influenced baseline and 18-month health status and physical function in a merged sample of older adults with knee OA from FAST and ADAPT. The eligibility criteria for the two trials were similar, allowing creation of a collective sample that permitted comparisons according to ethnicity.

METHODS

Overview of Study Designs

Fitness Arthritis in Seniors Trial

FAST was an 18-month, two-center, single-blind, randomized, controlled clinical trial conducted at the University of Tennessee, Memphis, Tennessee, and Wake Forest University, Winston-Salem, North Carolina. The purpose of FAST was to compare the effect of aerobic exercise, resistance training, and health education interventions on self-reported disability in older adults with knee OA. Secondary aims included comparing the effects of the interventions on physical performance, muscle strength, and health-related quality of life.

Arthritis, Diet, and Activity Promotion Trial

ADAPT was an 18-month, single-blind, parallel-arm, randomized, controlled clinical trial of older overweight and obese adults with knee OA. The primary purpose of ADAPT was to compare the effects of random assignment to four interventions (exercise, dietary weight loss (diet), diet plus exercise, and usual-care healthy-lifestyle control) on self-reported physical function. Secondary outcomes of ADAPT included the effects of the interventions on disability, weight loss, physical performance, pain, and knee radiographs. Both studies were conducted with the approval of the institutional review boards at all institutions.

Participants

Participants were community-based older adults with knee OA who were recruited through local advertisements and mass mailings. The two trials shared several inclusion criteria: aged 60 and older; pain on most days in at least one knee; difficulty with at least one of the following activities due to knee pain: walking one-quarter of a mile, climbing stairs, getting in and out of a car, rising from a chair, lifting and carrying groceries, getting out of bed, getting out of the bathtub, and performing self-care, shopping, or cleaning activities; and radiographic evidence of knee OA in the tibial-femoral compartment.

Exclusion criteria common to the two trials were presence of a medical condition that precluded safe participation in an exercise program or prevented completion of the study (e.g., myocardial infarction or stroke within the previous 3 months, evidence of ischemia during the exercise treadmill test), congestive heart failure, severe chronic obstructive pulmonary disease, active treatment for cancer, insulin-dependent diabetes mellitus, hemoglobin less than 110 g/L, creatinine greater than 176.8 μmol/L (>2.0 mg/dL), severe systemic disease, or major psychiatric disease; presence of inflammatory arthritis, such as rheumatoid or psoriatic arthritis; engaging in regular exercise (aerobic or resistance training at least 1 time per week for at least 20 minutes); planning to move from the area or to be admitted into a long-term care facility within the following 2 years; inability to walk at least 420 feet in 6 minutes without an assistive device; inability to walk on a treadmill without an assistive device; participation in another research study; and residence in a long-term care facility.

To investigate the effect of exercise therapy upon health status, analyses were restricted to participants randomized into exercise only and control conditions. Also, the sample sizes of Asians/Pacific Islanders (n = 1) and Native Americans (n = 1) were not sufficient to perform comparative analyses. Therefore, the final sample consisted of African-American and Caucasian-American participants who were randomized into exercise only and control conditions, described below.

INTERVENTIONS

FAST Aerobic Exercise Training

This intervention consisted of a 3-month facility-based walking program followed by a 15-month home-based walking program. During the facility-based phase, participants met three times per week at a central facility in classes of 10 to 15 participants under the direct supervision of a trained exercise leader and walked on an indoor track. After the facility-based program, participants followed a home-based program consisting of two phases: transition (Months 4–6) and maintenance (Months 7–18). During the transition phase, the exercise leader made four home visits and six telephone calls to each participant. During the home visits, the exercise leader worked with participants to develop a walking exercise program in their home environment. Most participants chose to walk on sidewalks along streets or in nearby parks, but some walked in a nearby facility such as a gymnasium or shopping mall. During the maintenance phase, the exercise leader contacted the participant by telephone every 3 weeks during Months 6 to 9 and then monthly during Months 10 to 18.

Each aerobic exercise session lasted 1 hour and consisted of three phases: a warm-up phase (10 minutes), a stimulus phase (40 minutes), and a cool-down phase (10

minutes). The warm-up phase consisted of slow walking and four calisthenics: arm circles, trunk rotation, shoulder and chest stretches, and side stretch. The stimulus phase consisted of participants walking at 50% to 70% of their heart rate reserve as determined from a screening exercise treadmill test. The cool-down phase consisted of slow walking, the four calisthenics from the warm-up phase, and three flexibility exercises: a shoulder stretch, hamstring stretch, and lower back stretch. Exercise was prescribed three times per week.

FAST Resistance Exercise Training

The resistance exercise program consisted of a 3-month facility-based program consisting of classes of 10 to 15 participants directed by a trained exercise leader, followed by a 15-month home-based program with the same number of contacts as in the aerobic intervention. The resistance training session lasted 1 hour and consisted of a warm-up phase (10 minutes), stimulus phase (40 minutes), and cool-down phase (10 minutes). After two orientation sessions, two sets of 12 repetitions of nine exercises were performed 3 days per week for 18 months. The nine exercises included leg extensions, leg curls, step-ups, heel raises, chest flies, upright rows, military presses, biceps curls, and pelvic tilts. Upper body exercises were performed with dumbbells and lower body exercises with cuff weights. Beginning with the lowest possible resistance (1.3 kg for the upper body and 1.1 kg for the lower body), weight was increased in a stepwise fashion as long as the participant could complete two sets of 10 repetitions. Once a plateau was reached, weight was increased after the participant performed two sets of 12 repetitions for 3 consecutive days. During the home-based phase, weights were exchanged at the participant's request or after a determination was made to increase the weight during the face-to-face or telephone contact.

Participants maintained exercise log books during all phases of the exercise interventions and recorded the number of prescribed exercise sessions completed and the length of each exercise session. Compliance with the exercise intervention was defined as the number of exercise sessions completed divided by the total number of sessions prescribed (3 times per week). Attendance during the center-based phase was determined using the exercise leader's records, whereas during the home-based portion, attendance was calculated using information from the exercise logs. Exercise compliance was defined as

$$(\text{number of exercise sessions completed}/\text{total number of prescribed sessions}) \times 100.$$

If participants did not complete their exercise logs in the home-based program, it was assumed that they were not exercising.

If a participant in either of the exercise intervention groups became ill or missed exercise sessions because of injury or other reasons during the 15-month home-based period, the exercise leaders were instructed to make an extra home visit or have the participant return to the facility for a booster session to adjust the participant's level of exercise as needed. Medical questions regarding the safety of continuing the exercise were referred to the participant's personal physician. Participants in both groups were provided with transportation to the facility-based sessions if they desired.

FAST Health Education Control

Health education participants were provided with social interaction and education about OA and served as an attention control group. During Months 1 through 3, participants engaged in 90-minute sessions administered by a trained nurse. The sessions consisted of a videotape presentation of topics related to OA, a question-and-answer period on arthritis-related issues, and a 15- to 20-minute social period. During Months 4 to 6, participants engaged in structured telephone interviews every other week on topics related to arthritis, general health status, and medication. During Months 7 to 18, telephone interviews were conducted monthly.

ADAPT Exercise-Only Condition

Participants in the exercise program engaged in a 4-month facility-based exercise program, followed by 14 months of continued exercise, chosen by the participant, in a home-based program, a facility-based program, or a combination of a home-based program and a facility-based program. During the 4-month facility-based phase, participants met three times per week under the direct supervision of two trained exercise leaders and walked on an indoor track. Participants were provided with an exercise prescription that included walking within a heart rate range of 50% to 75% of heart rate reserve. The resistance training portion of the program consisted of two sets of 12 repetitions of the following exercises: leg extensions, leg curls, heel raises, and step-ups. Cuff weights and weighted vests provided resistance. A 1- to 1.5-minute rest interval separated each exercise. After two orientation sessions, participants began with the lowest possible resistance. Weight was increased after the participant performed two sets of 12 repetitions for 2 consecutive days.

For participants in the home-based program, weights were exchanged at the participant's request or after a determination was made to increase weight during face-to-face or telephone contact. Telephone contacts were made biweekly during the first 2 months of home-based exercise, every three weeks during the following 2 months, and monthly thereafter.

Exercise and attendance logs were used to gather data and monitor progress. Exercise compliance was defined as:

$$(\text{number of exercise sessions completed}/\text{total number of prescribed sessions}) \times 100.$$

All medical questions regarding the safety of exercise were referred to the participant's personal physician.

ADAPT Healthy-Lifestyle Control

The healthy-lifestyle control group served as a usual-care comparison group and was designed to provide attention, social interaction, and health education. The group met monthly for 1 hour for the first 3 months. A health educator, who scheduled videotaped presentations and physician talks on topics concerning OA, obesity, and exercise, organized the healthy lifestyle program. Patients were advised to follow the American College of Rheumatology and Eu-

ropean League Against Rheumatism recommendations to lose weight and exercise as treatments for OA.[1,2] Question-and-answer sessions followed each presentation. Phone contact was maintained monthly during Months 4 to 6 and every other month during Months 7 to 18. During phone contact, information on pain, medications, illnesses, and hospitalization was obtained.

Outcome Measures

6-Minute Walk Test

Participants completed a 6-minute walk test conducted in a gymnasium as a performance measure of physical function. The validity and reliability of this test has been established for individuals with mobility disability.[27] Participants were asked to walk as far as they could in 6 minutes Each participant began walking at the command "go" and continued walking until he or she heard the command "stop." Participants were not given any performance feedback during the trial. Performance was measured as the total distance covered in feet.[27]

FAST Physical Functioning Questionnaire Index Score

The FAST Physical Functioning Questionnaire (PFQ) contains 23 items that assess difficulty with activities of daily living. For each item, participants were asked, "How much difficulty, if any, did you have over the past month doing (name of activity) because of your health or physical problem?" Participants were asked to answer using a Likert scale from 1 (usually done with no difficulty) to 5 (unable to do). Higher scores indicate less-favorable physical function. The FAST PFQ has five distinct subscales constructed using factor analysis: ambulation and stair climbing, transfer activities, upper extremity tasks, basic activities of daily living, and complex activities of daily living.[27] A composite disability score was created by averaging the scores of all 23 questions.

General Health Scale

The General Health Scale (GHS) from the RAND 36-Item Health Survey was used to measure participants' perceived health status.[28] This measure consists of five items rated on 5-point Likert scales with a range of 1 through 5. These items are summed and then transformed to yield a total score ranging from 0 to 100, with higher scores indicating more-favorable general health.

Demographic and Clinical Variables

Age, sex, ethnicity, education, and income were assessed using self-report. Height and weight were measured using a standard protocol to calculate body mass index (BMI) ((weight in kilograms/(height in meters)^2). Supine systolic blood pressure (SBP) and diastolic blood pressure (DBP) were assessed through physical examination. Cardiovascular disease (CVD) was defined as a self-report of myocardial infarction, angina pectoris, or stroke. Diabetes mellitus, kidney disease, cancer, and chronic obstructive pulmonary disease (COPD) were assessed via self-report. The sum of comorbidities was defined as the total of "yes" responses to CVD status, diabetes mellitus, kidney disease, COPD, and cancer. Interventions were categorized as exercise-only training or control group.

Statistical Analyses

One-way preliminary descriptive analyses of variance using ethnicity as a factor were conducted on the continuous variables, and Pearson chi-square tests were conducted on categorical variables.

Cross-sectional analyses of covariance (ANCOVAs) tested the effect of ethnicity upon baseline 6-minute walk, baseline FAST PFQ index, and baseline GHS transformed score. Covariates were age, education, income, BMI, CVD status, diabetes status, kidney status, COPD status, cancer status, and sum of comorbidities.

A second series of ANCOVAs were implemented to test the effect of ethnicity upon 18-month values of the aforementioned outcomes, using the same covariates as in the initial ANCOVA models, with the additional inclusion of the baseline value of the outcome and treatment as covariates. The alpha level for testing the significance of effects in each model was set at $P < .05$. All analyses were conducted using SPSS 10.10 (SPSS Corp., Chicago, IL).

RESULTS

Descriptive Statistics

Characteristics of the participants at baseline are shown in Table 1, partitioned by ethnicity. Collectively, the sample consisted of older men and women who were overweight; the African Americans had significantly higher BMI and blood pressure, higher prevalence of kidney disease and diabetes mellitus, and lower overall income and education.

Baseline Self-Report and Performance Measures

The baseline ANCOVA conducted on 6-minute-walk distance revealed a significant main effect for ethnicity ($F_{1,499} = 22.953$, $P < .001$) (Table 2). The covariates sex ($F_{1,499} = 24.494$, $P < .001$), age ($F_{1,499} = 58.937$, $P = .001$), BMI ($F_{1,499} = 45.827$, $P < .001$), SBP ($F_{1,499} = 6.782$, $P = .009$), and education ($F_{1,499} = 6.239$, $P = .01$) also yielded significant effects.

Table 2 also shows that the ANCOVA performed on baseline GHS score produced a significant main effect for ethnicity ($F_{1,510} = 11.112$, $P < .001$). The covariates BMI ($F_{1,510} = 6.969$, $P = .009$) and education ($F_{1,510} = 6.035$, $P = .014$) also yielded significant results.

The ANCOVA executed upon baseline FAST PFQ index score resulted in no main effects for ethnicity (Table 2), although there were significant effects for the covariates education ($F_{1,510} = 11.847$, $P = .001$), BMI ($F_{1,510} = 21.029$, $P < .001$), and SBP ($F_{1,510} = 9.345$, $P = .002$).

Exercise Compliance

An ANCOVA was conducted upon total exercise compliance, with ethnicity as the sole factor and the covariates used in the baseline models. Results indicated no differences in exercise compliance due to ethnicity between participants in the exercise-only conditions ($F_{1,315} = 0.933$, $P = .34$).

18-Month Self-Report and Performance Measures

The ANCOVA conducted on 18-month 6-minute-walk distance revealed no significant main effect for ethnicity

Table 1. Baseline Characteristics of FAST and ADAPT Participants by Ethnicity

Variable	African American (n = 143)	Caucasian American (n = 441)	*P*-value
Age	68.3 ± 6.1	68.9 ± 5.7	.29
Body mass index, kg/m^2, mean ± SD	34.2 ± 6.8	31.4 ± 5.7	<.001*
Systolic blood pressure, mmHg, mean ± SD	148.0 ± 18.9	143.4 ± 19.1	.011*
Diastolic blood pressure, mmHg, mean ± SD	83.8 ± 9.8	81.7 ± 9.8	.023*
Total number of comorbidities, mean ± SD	0.5 ± 0.8	0.3 ± 0.6	.035*
Cardiovascular disease, n (%)			.43
No	128 (91.4)	388 (90.9)	
Yes	9 (6.4)	35 (8.2)	
Chronic obstructive pulmonary disease, n (%)			.49
No	121 (87.1)	388 (89.2)	
Yes	18 (12.9)	47 (10.8)	
Diabetes mellitus, n (%)			.009*
No	119 (85.0)	402 (92.4)	
Yes	21 (15.0)	33 (7.6)	
Kidney disease, n (%)			.007*
No	130 (94.2)	427 (98.4)	
Yes	8 (5.8)	7 (1.6)	
Cancer, n (%)			.48
No	130 (91.5)		
Yes	12 (8.5)		
Income category, $, n (%)			<.001†
<10,000	38 (27.1)	62 (14.4)	
10,000–34,999	74 (52.9)	219 (50.7)	
35,000–49,999	20 (14.3)	79 (18.3)	
50,000–74,999	3 (2.1)	42 (9.7)	
>75,000	5 (3.6)	30 (6.9)	
Formal education, n (%)			<.001†
<12 years	52 (36.4)	57 (13.0)	
12 years	23 (16.1)	106 (24.1)	
Vocational school/associates degree	42 (29.2)	168 (38.2)	
College graduate/masters/doctorate	26 (18.2)	109 (24.8)	

Significant between groups at $P <$ *.01; †.001.

($F_{1,356} = 1.168$, $P = .28$). Baseline 6-minute-walk distance produced a significant effect ($F_{1,356} = 224.643$, $P < .001$). In addition, there was a significant effect for age ($F_{1,356} = 7.069$, $P = .008$) and BMI ($F_{1,356} = 7.684$, $P = .006$). Finally, exercise-only treatment produced a significant effect ($F_{1,356} = 11.445$, $P = .001$) (Table 3). The ANCOVA performed on 18-month GHS failed to produce a significant main effect for ethnicity ($F_{1,404} = 1.323$, $P = .25$). Baseline GHS score generated a significant effect ($F_{1,404} = 273.253$, $P < .001$), as did sum of comorbidities ($F_{1,404} = 5.868$, $P = .05$) (Table 3). Finally, Table 3 illustrates that the ANCOVA conducted upon 18-month FAST PFQ index score resulted in no significant effect for ethnicity ($F_{1,405} = 0.013$, $P = .83$). Several covariates produced

Table 2. Descriptive Statistics of Unadjusted and Adjusted* Baseline Means by Ethnicity

Statistic	African-American Raw Baseline	Caucasian-American Raw Baseline	African-American Adjusted Baseline	Caucasian-American Adjusted Baseline	*P*-value
	Mean ± Standard Deviation		Mean ± Standard Error of the Mean		
6-minute walk distance, feet	1,202.2 ± 247.9	1,401.3 ± 307.3	1,251.0 ± 24.5	1,386.6 ± 13.1	<.001†
General Health Scale score (range 0–100)	57.7 ± 17.5	66.6 ± 17.6	59.9 ± 1.6	65.9 ± 0.8	.001‡
Physical Functioning Questionnaire Index score (range 23–115)	2.0 ± 0.7	2.0 ± 0.5	2.0 ± 0.05	2.0 ± 0.0	.83

* Adjusted for age, sex, income, education, body mass index, systolic blood pressure, diastolic blood pressure, cancer, cardiovascular disease, kidney disease, diabetes mellitus, chronic obstructive pulmonary disease, and sum of comorbidities.
Significant at $P <$ †.001; ‡.05.

Table 3. Descriptive Statistics of Unadjusted and Adjusted* 18-Month Means by Ethnicity

Statistic	African-American Raw 18-Month	Caucasian-American Raw 18-Month	African-American Adjusted 18-Month	Caucasian-American Adjusted 18-Month	
	Mean ± Standard Deviation		Mean ± Standard Error of the Mean		*P*-value
6-minute walk distance, feet	1,224.7 ± 294.6	1,448.7 ± 363.2	1,370.1 ± 27.9	1,405.1 ± 14.5	.28
General Health Scale score (range 0–100)	59.8 ± 17.6	65.5 ± 18.6	65.8 ± 1.5	63.7 ± 0.8	.25
Physical Functioning Questionnaire Index score (range 23–115)	2.13 ± 0.7	1.98 ± 0.6	2.00 ± 0.05	2.01 ± 0.03	.83

*Adjusted for age, sex, treatment condition, baseline value, income, education, body mass index, systolic blood pressure, diastolic blood pressure, cancer, cardiovascular disease, kidney disease, diabetes mellitus, chronic obstructive pulmonary disease, and sum of comorbidities.

significant effects, including baseline FAST PFQ index ($F_{1,405} = 263.401$, $P < .001$), age ($F_{1,405} = 4.709$, $P = .03$), and exercise only treatment ($F_{1,405} = 6.219$, $P = .01$).

DISCUSSION

This study investigated the effect of ethnicity upon performance and self-report measures of baseline and 18-month health status in older adults with knee OA. Several relevant variables were considered as covariates in ANCOVA conducted on the outcomes. Collectively, these results suggest that African Americans with knee OA demonstrated poorer baseline health status than Caucasian Americans, although these differences were resolved after 18 months of exercise therapy.

These findings are relevant to outcome research in knee OA. Significant effects of ethnicity upon baseline 6-minute-walk distance and GHS were observed, specifically that Caucasian Americans displayed better scores than did African Americans. The results failed to reveal a significant ethnicity effect upon baseline FAST PFQ index score, but the possibility was considered that the large number of covariates in the model may have significantly reduced the power. Consequently, an ANCOVA was conducted using FAST PFQ index as the outcome measure, with the effect term of ethnicity, using age, sex, educational status, income, and supine SBP and DBP. This model also failed to yield a significant effect for ethnicity. The observed effect of ethnicity upon baseline 6-minute-walk distance and GHS score was not surprising, although it is intriguing that the ethnicity effect persisted despite the presence of many covariates in the ANCOVA models. Several covariates had significant effects upon the outcomes, yet collectively they failed to explain the effect of ethnicity on health status within this sample. Indeed, additional ANCOVAs were conducted on the baseline outcomes, adding average knee pain intensity as an additional covariate, although these analyses did not reduce the effect of ethnicity upon 6-minute-walk distance and GHS score.

There may be other mechanisms that help explain the effect of ethnicity on baseline health status in older adults with knee OA, some of which were beyond the scope of the FAST and ADAPT trials. For example, researchers have examined the role that levels of potential biomarkers such as cartilage oligomeric matrix protein[29] and dietary factors[30] may play in explaining the relationship between ethnicity and health status in individuals with knee OA. African Americans have reported significantly higher (i.e., less favorable) scores on the Food Habits Questionnaire than Caucasian Americans or Hispanic Americans[31] and are also less likely to eat meatless meals or modify meats to lower fat content than Caucasian or Hispanic Americans. More research is needed to investigate the possible relationship between dietary intake and knee OA severity or cartilage loss.

The finding that there were no significant differences in health status after 18 months of exercise therapy supports previous findings regarding the robust positive effect of regular physical activity on health status. This finding also prompts postulation to identify the factors that produced the markedly better improvements in African-American than Caucasian-American participants.

African-American participants demonstrated markedly greater improvement in 6-minute-walk distance than Caucasian-American participants, which was accompanied by a better perception of health status according the GHS score. It is reasonable to assume that the improvement in GHS was due in part to the effects of regular exercise on cardiovascular and musculoskeletal fitness. Another explanation may reside in the nature of the GHS items and in the group-oriented nature of the facility-based training phase of the interventions. Two of the GHS items ("I am as healthy as anyone I know" and "I seem to get sick easier than other people") require the respondent to make comparative statements. The group setting of exercise and the evaluative feedback of interventionists may have allowed African-American participants to make more-realistic appraisals of their health status than at the baseline assessment. Hence, the improvement of GHS score in African Americans may have been in part due to a realization that their health status was indeed similar to that of other individuals in their groups.

Psychosocial factors may also have influenced the relationship between ethnicity and health status in these participants. One group of researchers has written extensively on the role of self-efficacy beliefs in attenuating functional decline in older adults with knee pain and knee OA, finding in several investigations that self-efficacy accounted for 15% of the variance in performance,[32] that self-efficacy was enhanced through participation in aerobic and resistance exercise interventions,[33] and that participants who had low self-efficacy and low knee strength at baseline had the largest decline in self-reported disability and stair climb performance at 30 months.[13] Perhaps African-American

participants' self-efficacy was enhanced to a greater degree than Caucasian Americans' through the exercise interventions.

These results emphasize the importance of considering ethnicity and baseline status as factors in the effect of knee OA on health status and provide encouraging evidence that long-term exercise therapy should be encouraged to resolve health disparities in older adults. Finally, these results support current recommendations for physical activity in older adults with chronic disease.

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